

Grant of Nasa  
Contract No. NASr - 174

Status Report No 7  
1 June - 31 August 1965  
Highly Ionized Spectra of Nitrogen and Oxygen

Kjell Bockasten  
Physics Department  
University of Uppsala  
Uppsala, Sweden

N 65 89194

|                   |                               |            |
|-------------------|-------------------------------|------------|
| FACILITY FORM 602 | (ACCESSION NUMBER)            | (THRU)     |
|                   | 5                             | None       |
|                   | (PAGES)                       | (CODE)     |
|                   | CR-67503                      | (CATEGORY) |
|                   | (NASA CR OR TMX OR AD NUMBER) |            |

Highly Ionized Spectra of Nitrogen and Oxygen.

(K. Bockasten, J. Bromander, R. Hallin, B. Johansson)

During the period our work has given new results mainly in the NIV and OIV spectra.

A list of observed NIV lines in the region 400 - 1250 Å and an intercombination line at 1486 Å is given in Table 7. The other NIV lines in the region 1250 - 2100 Å were given in the preceding status report in Table 6. Two intercombination lines in NIV have been observed. They are  $2s\ ^1S_0$  -  $2p\ ^3P_1$  at 1486 Å and  $2p\ ^3P_2$  -  $2p'\ ^1D_2$  at 823 Å. With these intercombinations it is possible to connect the singlet system and the triplet system. The correction  $\chi$  added to the triplet Terms of NIV in Ch. Moore's tables of atomic energy levels (NBS circular 467, Vol 1, p. 41) is  $72.7 \text{ cm}^{-1}$ .

A preliminary list of OIV lines is given in Table 8. With these new lines it is possible to calculate the energy levels of  $4p\ ^2P$ ,  $4f\ ^2F$ ,  $5,6,7g\ ^2G$ ,  $6,7h\ ^2H$  and  $7i\ ^2I$  in OIV. The combinations  $3s\ ^2S$  -  $4p\ ^2P$  are probably masked by an OIII line at 702 Å;  $4p\ ^2P$  -  $5d\ ^2D$  by OIII lines at 1923 and 1921 Å; and  $3d\ ^2D$  -  $4p\ ^2P$  by the NV resonance line at 1242 Å. The term  $4f\ ^2F$  appears to be disturbed by  $3d'\ ^2F$ .

Table 7. Preliminary list of NIV lines

| Intensity | $\lambda$<br>vac. Å | Previous<br>measurements | $\nu$<br>obs. cm <sup>-1</sup> | Combination         |
|-----------|---------------------|--------------------------|--------------------------------|---------------------|
| 4         | 463.736             | .743 E                   | 215 639.9                      | $2p^1D_2 - 3p^1P_1$ |
| 15        | 765.148             | .140 E                   | 130 693.7                      | $2s^1S_0 - 2p^1P_1$ |
| 2         | 823.273             |                          | 121 466.4                      | $2p^3P_2 - 2p^1D_2$ |
| 10+       | 921.992             | .982 E                   | 108 460.8                      | $2p^3P_1 - 2p^3P_2$ |
| 10        | 922.519             | .507 E                   | 108 398.9                      | $3P_0 - 3P_1$       |
| 11        | 923.057             | .045 E                   | 108 335.7                      | $3P_1 - 3P_1$       |
| 9         | 923.220             | .211 E                   | 108 316.5                      | $3P_2 - 3P_2$       |
| 10        | 923.675             | .669 E                   | 108 263.2                      | $3P_1 - 3P_0$       |
| 10+       | 924.283             | .274 E                   | 108 192.0                      | $3P_2 - 3P_1$       |
| 2         | 948.155             |                          | 105 468.0                      | $3p^3P_0 - 4d^3D_1$ |
| 3         | 948.244             |                          | 105 458.1                      | $3P_1 - 3D_2$       |
| 4         | 948.540             |                          | 105 425.2                      | $3P_2 - 3D_3$       |
| 11        | 955.335             | .335 E                   | 104 675.3                      | $2p^1P_1 - 2p^1S_0$ |
| 4         | 1078.708            |                          | 92 703.5                       | $3d^1D_2 - 4f^1F_3$ |
| 3         | 1133.117            |                          | 88 252.1                       | $3s^3S_1 - 3s^3P_2$ |
| 2         | 1135.244            |                          | 88 086.8                       | $3S_1 - 3P_1$       |
| 1         | 1136.241            |                          | 88 009.5                       | $3S_1 - 3P_0$       |
| 5         | 1188.005            |                          | 84 174.7                       | $3s^1S_0 - 3s^1P_1$ |
| 1         | 1224.960            |                          | 81 635.3                       | $3p^3P_0 - 3p^3S_1$ |
| 3         | 1225.192            |                          | 81 619.9                       | $3P_1 - 3S_1$       |
| 4         | 1225.719            |                          | 81 584.8                       | $3P_2 - 3S_1$       |
| 2         | 1486.496            |                          | 67 272.3                       | $2s^1S_0 - 2p^3P_1$ |

Reference to previous measurements:

Table 8. Preliminary list of OIV lines.

| Intensity    | $\lambda$ Å    | $\nu_{\text{obs.}}$ cm <sup>-1</sup> | Combination                 |
|--------------|----------------|--------------------------------------|-----------------------------|
|              | $\lambda$ vac. |                                      |                             |
| 1            | 594.22         | 168 288                              | $3d^2D - 7f^2F$             |
| 2            | 617.80         | 161 865                              | $3p^2P_{1/2} - 5d^2D_{3/2}$ |
| 4            | 618.12         | 161 781                              | $^2P_{3/2} - ^2D_{5/2}$     |
| 2            | 752.17         | 132 949                              | $3d^2D - 5f^2F$             |
| 8            | 830.51         | 120 408                              | $3p^2P_{1/2} - 4d^2D_{3/2}$ |
| 10           | 831.08         | 120 325                              | $^2P_{3/2} - ^2D_{5/2}$     |
| 5            | 1045.34        | 95 662.7                             | $3p^2P_{1/2} - 4s^2S_{1/2}$ |
| 10           | 1045.28        | 95 668.4                             | $^2P_{3/2} - ^2S_{1/2}$     |
| 20           | 1067.81        | 93 649.6                             | $3d^2D - 4f^2F$             |
| 5 wide       | 1604.90        | 62 309.2                             | $4f^2F - 6g^2G$             |
|              | $\lambda$ air  |                                      |                             |
| 5            | 2120.58        | 47 142.0                             | $3p^2P_{3/2} - 3d^2P_{3/2}$ |
| 2            | 2132.50        | 46 878.6                             | $^2P_{1/2} - ^2P_{1/2}$     |
| 1            | 2538.89        | 39 375.5                             | $4p^2P_{1/2} - 5s^2S_{1/2}$ |
| masked SiIII | 2541.          |                                      | $^2P_{3/2} - ^2S_{1/2}$     |
| 2            | 3057.71        | 32 694.7                             | $3p^2P_{3/2} - 4p^2P_{3/2}$ |
| masked OIV   | 3052.          |                                      | $^2P_{1/2} - ^2P_{1/2}$     |
| 3 bl OI      | 4344.4         | 23 011.8                             | $5f^2F - 6g^2G$             |
| 7            | 4631.91        | 21 583.3                             | $5g^2G - 6h^2H$             |
| 0            | 6876.48        | 14 538.3                             | $3s^2P_{1/2} - 3p^2P_{3/2}$ |
| 2            | 6931.46        | 14 423.0                             | $^2P_{1/2} - ^2P_{1/2}$     |
| 4            | 7004.30        | 14 273.0                             | $^2P_{3/2} - ^2P_{3/2}$     |
| 1            | 7061.37        | 14 157.7                             | $^2P_{3/2} - ^2P_{1/2}$     |

| Intensity | $\lambda, \text{\AA}$ | $\sigma_{\text{obs.}} \text{cm}^{-1}$ | Combination                       |
|-----------|-----------------------|---------------------------------------|-----------------------------------|
| 7         | 7032.24               | 14 216.3                              | $4s \ ^2S_{1/2} - 4p \ ^2P_{3/2}$ |
| 5         | 7053.71               | 14 173.0                              | $^2S_{1/2} - ^2P_{1/2}$           |
| 2         | 7527.7                | 13 280.6                              | $6f \ ^2F - 7g \ ^2G$             |
| 6         | 7676.57               | 13 023.1                              | $6g \ ^2G - 7h \ ^2E$             |
| 8         | 7712.48               | 12 962.4                              | $6h \ ^2H - 7i \ ^2I$             |